

The ANNIE experiment: measuring neutron yield from neutrino-nucleus interactions

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The Accelerator Neutrino Neutron Interaction Experiment (ANNIE) is a Water Cherenkov (WCh) - based neutrino experiment downstream of the Booster Neutrino Beam at Fermilab, designed to study the abundance of final state neutrons from neutrino-nucleus interactions. The measurement is enabled by two new techniques with wide relevance for neutrino physics: (1) the first application of Large-Area Picosecond Photodetectors (LAPPDs) to localize primary neutrino interaction vertices within a small fiducial volume through precision timing measurement, and (2) the use of gadolinium-doped water to count the number of final-state neutrons through the measurement of emitting gammas from neutron captures. Phase I of ANNIE is currently being performed on the Booster Neutrino Beam (BNB) in Fermilab, aiming to provide the neutron background of neutrino interactions. A small movable volume of gadolinium-loaded liquid scintillator is used to measure the rate of neutron events as a function of positions inside the water tank. Phase II of ANNIE is designed to fully demonstrate the realization of the ANNIE detector. During this stage, additional PMTs and functional LAPPDs will be covering the entire water tank, which enables detailed reconstruction of kinematics. This presentation will give an overview of the experiment, the techniques to be used, the reconstruction algorithms and the current project progress.

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